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# INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

CHICAGO 16, ILLINOIS

# GAS ABSTRACTS

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O. P. BRYSCH, Editor

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# 1. GAS INDUSTRY

## FPC Regulation

Hedrick, J. J., WHAT FORMULA IS ACCEPTABLE, *Gas Age*, 118, 42-43 (1956) October 4.

The president of Natural Gas Pipeline Co. of America and of the Independent Natural Gas Association of America proposes that any solution to the current problems surrounding the proposed increased regulation of the business requires the three principal segments of the industry to understand one another's problems and adjust their claims accordingly.

R. F. Bukacek

Kuykendall, J. K., "THESE ARE DAYS THAT TRY MEN'S SOULS." *Gas Age*, 118, 39-41 (1956) October 4.

The chairman of the Federal Power Commission outlines the position of the commission under the present difficult conditions.

R. F. Bukacek

Mitchell, D. H., WHERE DO WE GO FROM HERE? *Gas Age*, 118, 36-37 (1956) October 4.

This article by the president of the American Gas Association expresses the point of view that business should remain free from Federal regulation unless there is a definite and clear need for such regulation in the public interest. He discusses the mutual interest and interdependence of the various parties in the dispute surrounding the Federal regulation of independent producers. R. F. Bukacek

## Gas Supply

Walker, T. P., SOME COMMENTS ON GAS SUPPLY, *Public Utilities Fortn.*, 58, 666-69 (1956) October 25.

Gas supplies will become more scarce and the new fields harder to produce. This will lead to higher gas prices. The author predicts increased use of fuel gas because of its advantages as a fuel. The major need now is for corrective legislation to give the FPC a clear directive on control of natural gas production.

W. G. Blair

## Gas Cost and Price

Herz, H., IMPACT OF COST ALLOCATION ON GAS PRICING. *Public Util. Fortn.*, 58, 685-99 (1956) October 25.

This writer has reviewed foreign as well as American industrial literature and regulatory precedent to determine the scope of consideration which might be desirable with respect to cost allocation in pricing gas service. He finds some surprising gaps and deficiencies, but also makes practical suggestions for a new evaluation and reformation of gas pricing practices from the standpoint of sound economics.

Author's Abstract

## H-Bomb Survival

Bruckmann, B. W., INDUSTRY UNDER ENEMY ATTACK. *Mech. Eng.*, 78, 932-6 (1956) October.

Living in the H-bomb age as we do, the importance of systematic planning for industrial continuity following an enemy attack cannot be overemphasized. Such continuity demands that the individual be instructed in the means of survival, for there is a direct relationship between individual welfare and industrial continuity. There must be protection of both industry and the individual, preferably underground. There must be stock-piling of weapons, of substitute electric power and communications facilities, and of basic essential commodities—food, water, fuel, and medical supplies. Emergency plans must be set up for both industry and community. Passiveness toward planning and organization must be thoroughly dispelled. Author's Abstract

## Middle East Oil

NASSER CONTROLS IRAQ OIL FLOW. *Petroleum Week*, 3, 24 (1956) December 28.

No Iraq oil will flow to the Mediterranean until Egypt gives the word. This was disclosed by an official Syrian source last week. The order to permit resumption of the flow of oil from northern Iraq through Syria must come from Egypt, he said. The official explained that the Syrian government cannot make decisions regarding Iraq Petroleum Co.'s oil flow to the Mediterranean, because "petroleum affairs are now handled by the Syrian Army." Likewise, he added, the Syrian Army cannot act before getting approval of the joint Syrian-Egyptian Army High Command, in Cairo. This is headed by Egyptian War Minister and Commander-in-Chief Gen. Abdul Hakim Amer. This means that any order must come directly from Egyptian President Abdel Gamal Nasser.

Author's Abstract

### Russian Energy

Ferlet, M., DIE ENERGIEWIRTSCHAFT DER UdSSR. (THE ENERGY ECONOMY OF USSR). *Gas- und Wasserfach* (German), 97, 818-22 (1956) October 1.

Observations noted by a committee of technical men on a 24-day tour of 12 industrial areas of USSR are given briefly. Energy reserves include: coal, 1,650 billion tons; petroleum, 6 billion tons (known); water power, 1,700 billion kwh; natural gas, 1,000 billion cu. m. (approx.). Of this, 1954 production was: coal, 339 mill. ton; peat, 44 mill. ton; petroleum, 60 mill. ton; natural gas, 5.7 bill. cu. m.; water power, 21.6 bill. kwh. Technical ministries and plans are outlined. The three pipelines (from Saratow, Dachava and Stawropol) to Moscow, are described, as well as details of gas production and distribution. The Moscow methane liquefaction plant is discussed, and the Volga electric stations, the atomic power plant and the Baku oil region are treated briefly. O. P. Brysch

### Starting Salaries

Teal, E. A., WHAT ARE YOU GOING TO PAY? *J. College Placement*, 17, 7 (1956) October.

The author examines trends of the last five years in starting salaries, the influence of the annual increases labor unions have been able to obtain, and other factors to prognosticate starting salaries for technical graduates in 1957. Based on the most recent labor gains, he feels starting salaries for technical graduates next year will be between $455 and $465. R. T. Ellington

## 2. APPLIANCES

### Air Conditioning

Janssen, J. E., and McNall, P. E., Jr., HOW CYCLING RATE AFFECTS HUMIDITY CONTROL. *Refrig. Eng.*, 64, 37-40, 101-02 (1956) November.

On the basis of field reports, a theoretical analysis presented here, and experimental laboratory studies now in progress, it appears that better control of relative humidity can be realized with a residential air conditioning installation if proper attention is given to the cycling rate provided by the thermostat. Since a system with provisions for reheat is considered too costly for general application to the residential cooling field at this early stage of development, the humidity control characteristics of the cooling unit when it is operating under control of the thermostat are of considerable importance for the maintenance of comfort. Authors' Abstract

Rogers, A. N., HOW TEMPERATURE AND ALTITUDE AFFECT FAN SELECTION. *Air Condg., Heatg. and Ventilg.* 53, 92-96 (1956) December.

Since the density of air is definitely a variable, it is apparent that factors such as temperature and altitude which affect the density of air, will also have a bearing on fan selection. The engineering aspects of these relationships are presented for a better understanding of conditions that are encountered in practice.

Author's Abstract

NEW JET-PRINCIPLE GAS AIR CONDITIONER UNVEILED. *Amer. Gas J.*, 183, 64 (1956) October.

The article explains the new jet-principle gas air conditioner and heating operation. Included in the explanation is the operating procedure of the change from cooling to heating—or from heating to cooling. Also given are the different installation procedures applied with this unit, as well as a simple and interesting explanation of the jet operation itself. The units are still in the field testing stage and will not be on the market before 1958.

A. M. Pelczarski

PROTOTYPE OF GAS AIR CONDITIONER UNVEILED FOR PRESS, *Gas*, 32, 64-65 (1956) November.

A centrally operated gas, year-around air conditioner for homes to provide heating, cooling, humidity control, filtration and circulation of air will not be marketed until 1958 according to officials of Rheem Manufacturing Co. In operational costs and price-wise it will be competitive with electrically operated units. The unit will employ the jet principle of refrigeration. It is expected to balance the trend for heavy winter consumption of gas as compared to low summer usage, resulting in a more uniform year-around consumption. A. E. Richter

## Burners

DuFault, H. D., RADIANT GAS BURNER APPARATUS. U. S. 2,771,132 (1956) November 20.

Hook, C. H., BURNERS FOR GAS FIRED BOILERS. U. S. 2,771,131 (1956) November 4.

Aleksandrovich, A. E., GAS BURNERS FOR CITY OF MOSCOW GAS. *Gazovaya Promyshl. (Gas Industry)* (Russian), 14-18 (1956) October.

Because of the absence of an all-Union organization there are no standard combustion requirements for gas appliances. These problems have been solved on a local basis. Gas supplied to Moscow is a mixture of natural and manufactured gas. Different mixtures are used in different sections of the city. An average is 628 Btu and 0.46 specific gravity. Gas pressure is 2 in. water in the low pressure area and 118 in. water in the intermediate pressure area. Proposed requirements for household appliances include: CO not greater than 0.02% by volume without vent, (0.10% with vent). Flashback should not occur with burner inputs reduced to 25% below normal for the low pressure system, and to 65% below normal for the intermediate pressure system. Blow-off should not occur when gas pressure increases to 4 in. water for low pressure system, and to 200 in. water for the intermediate pressure system. Drawings and descriptions are given for ten typical household and industrial burners.

J. W. Penney

## Convective Ventilation

Hatch, T. F., and Barron-Oronzco, D., AIR FLOW IN FREE CONVECTION OVER HEATED BODIES. *Heatg., Pipg., Air Condg.*, 28, 117-23 (1956) October.

The material in this paper can be used as a basis for determining exhaust ventilation requirements for hot processes in industry. Reported are the results of a laboratory study of free convection flow past heated bodies, the objective of which was to relate the magnitude of flow at various distances above the hot body and, more particularly, to its rate of convective heat release. It was desired to express the relationship in the form of a general equation by means of which the design engineer could estimate the cross-sectional dimensions, velocity, and overall rate of flow of the rising air stream at any desired distance above a given piece of hot process equipment where an exhaust hood was to be placed.

Authors' Abstract

## Gas Range

Knoy, M. F. (assigned to Institute of Gas Technology, Chicago), GAS RANGE. U. S. 2,762,360 (1956) September 11.

This patent covers the invention of a gas range having totally-enclosed burners constructed for the indirect heating of the cooking vessels and provided with insulated flues for venting the combustion products outside of the kitchen. It is claimed that this range will not cause overheating of the kitchen or the dissemination of cooking odors, vapors and grease in the kitchen. In addition, it is claimed that the burners on this type of range can be more easily adapted for thermostatic control than conventional burners.

S. Close

## Space Heating

Kimber, D. E., REVIEW NO. 163 DOMESTIC HEATING APPLIANCES: THE ASSESSMENT OF COMFORT. *Brit. Coal Utilis. Res. Assoc. Monthly Bull.*, 20, 385-394 (1956) October.

One of the first requirements of a space heater is that it should provide comfort. Thus, in assessing the performance of such an appliance, it is important to take account not only of its thermal efficiency but also of how the heat it provides will affect the distribution and quality of warmth in the rooms in which it is used. It is important, therefore, to look beyond the factors concerned with thermal efficiency and attempt to assess appliances by their ability to produce comfortable conditions. To this end a knowledge is necessary of the factors determining human comfort and of their measurement. The work described in this paper will have served to indicate the adequate background of basic knowledge about human comfort which is available. Certain problems still remain to be solved, but enough is known to

enable assessment of the performance of an appliance by the comfort created by it to take its place with the purely thermal assessments now used. Author's Abstract

THERMAL DESIGN OF WARM WATER CONCRETE FLOOR PANELS. *Heatg., Pipg., Air Condg.*, 28, 125-29 (1956) October.

This paper presents a simplified procedure for the thermal design of water heated floor panels for use in residences and commercial buildings. It complements the previously published paper. The procedures in both papers are based primarily on the experimental data obtained at the ASGAE Research Laboratory under the guidance of the ASGAE Technical Advisory Committee on Panel Heating and Cooling. This work has been reported in a series of research papers which are listed in the references, together with other papers which are listed in the references, together with other papers which contain supplementary data. A panel designed by this procedure will maintain the desired room air temperature for the selected outdoor conditions. Room air temperature is the selected criterion of comfort, and the design procedure is restricted to situations in which the area-weighted average temperature of the walls, the ceiling, and glass does not differ greatly from room air temperature. The room-scale tests, which simulated various conditions of construction and outdoor temperature, showed that this near-equality of the 2 temperatures normally prevails.

Authors' Abstract

## 3. COMBUSTION AND INDUSTRIAL FURNACES

### Air Pollution

CLEAN AIR. (Supplement to The Leeds Journal.) Leeds: Leeds Inc. Chamber of Commerce (1956) September.

The British publication is designed to disseminate practical information on air pollution abatement to industry, local authorities and householders. After a detailed discussion of the provisions of the national Clean Air Act of July 5, 1956, the booklet comprises brief articles on fuel efficiency, fuel characteristics, furnace installations, boiler-house instrumentation, firing training, oil fuel, dust removal, iron and steel works problems, alkali-act process pollutants, railway firing, ships in port, smoke control areas, nuisances, domestic heating, pollution research, pollution activities in U.S.A., as well as six appendices pertaining to government agencies dealing with fuel efficiency and smoke abatement. O. P. Brysch

### Exhaust Cleanup

Bowen, W. M., III, and Houdry, E. J. (assigned to Oxy-Catalyst, Inc.), EXHAUST GAS TREATING UNIT. U. S. 2,772,147 (1956) November 27.

In the present invention the catalyst in discrete or pellet form is arranged in a layer of predetermined thickness upon an apertured support of grid which is maintained in horizontal position. The support is subjected to slight but rather rapid movement so that the mass of catalyst is caused to vibrate or dance on the support, the individual pieces turning and rubbing against one another and against the support so that their surfaces are freed of deposits in a substantially continuous manner. The reactants are passed through the catalytic zone while the catalytic mass is in a state of agitation. Additional pieces of catalyst are fed from a hopper to the layer as required to maintain the layer at predetermined depth, and the spacing of the outlet of the hopper from the support determines the depth of the layer of catalyst.

H. A. Dirksen

### Nuclear Energy Processes

Hutchinson, F. W., AN INTRODUCTION TO NUCLEAR RADIATION AND TO NUCLEAR ENGINEERING: PART II. *Air Condg., Heatg. and Ventilg.*, 53, 82-95 (1956) September.

A comprehensive review of nuclear phenomena is given, starting with the transmutation of elements and types of decay mechanisms. The principles of fission or splitting of heavy nuclei and fusion or combination of light nuclei, both processes releasing large amounts of energy, is described. These are examples of the conversion of matter into energy. The opposite case, i.e., conversion of energy into matter is observed in the formation of oxygen - 17 isotope by bombardment of nitrogen with alpha particles. Types of radiation damage are cited, and it is pointed out that co-valent bond com-

pounds (organic) are most susceptible to deleterious effects. Metals undergo neutron radiation damage primarily by transmutation, specific examples being the transmutation of aluminum to silicon, magnesium to aluminum, and silicon to phosphorus. In doing so, dangerous gamma rays are emitted in most instances. The absorption of gamma rays by certain materials gives rise to additional neutrons, an effect known as photodisintegration. The effects of radiation on body cells arises principally by disruption of covalent bonds and by ionization of the molecules of the tissue. Radiation damage to brain cells is irreparable. Tolerance limits are specified. C. G. von Fredersdorff

Manowitz, B., Metz, D. J., and Bretton, R. H., DESIGN STUDY OF A MEGACURIE SOURCE. *Science*, 124, 814-17 (1956) October 26.

The possibility exists of simultaneously producing power and cobalt-60 in megacurie quantities in a nuclear power reactor. By a proper spacing arrangement of stainless steel-covered slabs of cobalt-59, the operating characteristics of the reactor as regards power production can be improved, and irradiated cobalt produced at no power loss, in amounts of one million curies per year for a 500-megawatt heat-power equivalent nuclear reactor. Design formulae and drawings are included. C. G. von Fredersdorff

## Power Burners

Lowe, F. J., Jr., INTRODUCTION TO POWER GAS BURNERS. *Gas Heat*, 7, 38-41 (1956) November.

This is the first of a series covering details of burners ranging from 100,000 Btu domestic models to 5,000,000 Btu industrial jobs. Specifically covered are three common types of burners, their method of operation, controls, troubles and corrective measures to be taken intended primarily to familiarize contractors with the equipment involved in large input burners. A. E. Richter

## Solar Furnace

Benveniste, G., and Hiester, N. K., THE SOLAR FURNACE: NEW TOOL FOR HIGH-TEMPERATURE WORK. *Mech. Eng.*, 78, 915-20 (1956) October.

Solar radiation intensities, usually 1.35 kw/sq meter outside the atmosphere, vary between 0.8 to 1.1 kw/sq meter in the U.S.A. By means of a parabolic reflector it is possible to concentrate this energy several thousand-fold to obtain limiting temperatures up to 3500° C. in the reflected image. This offers a new tool for high temperature laboratory research where high purity of the confining atmosphere is an important consideration. A typical application is the melting of zirconium oxide. Solar furnaces have been constructed at Mount Louis, France; near Algiers; in Japan, India and various locations in California, Arizona, Utah, West Virginia and Ohio. Some mathematical equations and solar efficiency data are included.
C. G. von Fredersdorff

## Submerged Combustion

Weyermuller, G. and Goodson, J., EFFICIENTLY EVAPORATES IRON CHLORIDE SOLUTION, *Chem. Processing*, 19, 116-118 (1956) October.

Four triple-burner submerged combustion units using 40,000 cu. ft/hr of 1020 Btu/cu ft. natural gas evaporate 40,000 lbs. of water per hour to successfully dispose of waste solution containing $FeCl_2$ $FeCl_3$ and other salts obtained from the purification of tin ore, in a method that prevented contamination of the water in Galveston Bay. A. E. Richter

Young, E. C., GAS-FIRED FIELD PROCESSING EQUIPMENT. *Petrol. Eng.*, 28, B122, 132, 134-36 (1956) November.

A short review is presented of the use of immersion-fired liquid heaters. Data on the temperature distribution along the immersion tube is given. R. T. Ellington

## Weather and Demand

Wunsch, W., and Tuppeck, F., UNTERSUCHUNGEN UEBER DIE ZUSAMMENHAENGE ZWISCHEN WITTERUNG UND GASVERBRAUCH. (INVESTIGATIONS ABOUT THE RELATIONSHIP BETWEEN WEATHER AND GAS CONSUMPTION). *Gas- und Wasserfach* (German), 97, 977-981 (1956) December 1.

This article describes a method of correlation between weather (wind, precipitation and humidity) and gas consumption, which is of primary importance for every gas supplier. With

the help of mathematical statistics an example of these multiple correlations is presented for one of the biggest cities in the Ruhr region in Germany. Explanations are given on how to obtain results with low amounts of uncertainties. All results, however, are valid only for the period for which they are calculated. Extrapolations for the future are possible with the knowledge of distribution development and seasonal fluctuations. This knowledge introduces an essential safety factor in the gas supply and demand. G. Kunst

## 4. CARBONIZATION AND GASIFICATION

### Coal Constitution

Wyss, W. F., HYDROXYL GROUPS IN BRIGHT COALS. *Chem. and Ind.* (British), No. 40, 1095-96 (1956) October 13.

Research work extended to include coals of carbon content up to 90% to determine the proportion of total oxygen present in the form of phenolic hydroxyl groups in coals and their solvent extracts showed that the relation between the carbon content of a coal and its acetylatable hydroxyl content is linear and that the proportion of total oxygen present in this form remains very nearly constant at 38% in coals up to a carbon content of 89.5%. With coals of higher carbon content, there is a marked discontinuity in the relation between carbon and hydroxyl and the ratio of oxygen as hydroxyl to total oxygen falls rapidly to one-tenth or less. Infra-red studies have also revealed similar results. K. C. Channabasappa

### Coal Distillation

de Vries, H. D., Buenos Aires, Argentina (assigned to United States of America), FURNACE FOR CONTINUOUSLY DISTILLING BITUMINOUS COAL. U. S. 2,768,943 (1956) October 30.

A continuous distillation furnace is claimed for swelling coals of asphaltic and bituminous type, which comprise a lower heated, horizontal tube through which the coal is moved by a screw conveyor and a parallel adjacent upper tube with an apertured common wall between the tubes, and a mechanism for scraping obstructions from the apertures to permit escape of gases and volatiles through the upper tube. O. P. Brysch

Wigton, H. F. H., DISTILLATION OF VOLATILE MATTERS OF CARBONACEOUS MATERIALS. U. S. 2,768,937 (1956) October 30.

This patent describes an improved method of recovering volatile matter from non-agglomerating materials, such as shales, lignites, and woods by low temperature carbonization in a single pass system. This consists of passing the fluidized particulated materials at substantially uniform velocity upwardly through a distillation zone heated to temperatures sufficiently high to effect pyrolytic decomposition of the carbonaceous materials. The resulting carbonaceous gases and vapors are distilled without substantial undesirable pyrolysis, by heat applied directly from a combustion zone heated centrally and within the circumjacent distillation zone. The products of distillation are separated from carboniferous residues by the introduction of a pressurized charge of fluidizing gas into the distillation zone concurrently with the charge, whereby the charge is maintained in a fluidized state, the carbonaceous residues are classified and discharged to the combustion zone, separating the gasiform distillation products into gases and vapors. The recovered gases are compressed and returned to the distillation step as fluidizing gas. K. C. Channabasappa

### Coal Plasticity

Van Krevelen, D. W., Huntjens, F. J., and Dormans, H. N. M., CHEMICAL STRUCTURE AND PROPERTIES OF COAL—XVI: PLASTIC BEHAVIOR ON HEATING. *Fuel* (British) 35, 462-75 (1956) October.

Study of several coals of various ranks over the range of plastic softening and decomposition is reported. Results with the Gieseler plastometer, the Arnu dilatometer and volatile-loss tests, each similarly conducted at several rates of heating as well as at constant temperature are compared. The data supports the theory that heating causes depolymerization of the coal macromolecule, which plasticizes or softens due to films of mobile small molecules or low molecular-weight coal fractions. Such softening increases, with decomposition ("degassing"), as temperature increases, so that all three test methods show a maximum value at the same temperature for a given coal but the original physical coal structure persists to

some varying degree, and exerts a strong influence on swelling and apparent fluidity. Tests of a coal "analog" of synthetic resins gave plasticity results closely similar to coal.

O. P. Brysch

## $CO_2$ Removal

Benson, H. E., Field, J. H., Haynes, W. P., $CO_2$ ABSORPTION USES HOT CARBONATE SOLUTIONS. *Chem. Eng. Progress*, 52, 433-38 (1956) October.

An improved process has been developed for removing carbon dioxide from pressurized gases, such as gas mixtures for the ammonia and Fischer-Tropsch synthesis. A previous study of a process utilizing absorption with a hot solution of potassium carbonate indicated that a relatively small amount of steam was required for regeneration of the spent solution. In this paper the results of further investigation of the hot carbonate process in a pilot plant are given with emphasis placed upon the determination of the steam consumption for regeneration at many operating conditions. For purposes of comparison, results of similar tests are shown for solutions of monoethanolamine operated at conventional absorption conditions. Experiments were made with carbon dioxide-nitrogen mixtures in a 30-ft. high absorber and a 25-ft. high regenerator. It is believed that the data are applicable to large-scale installations. Authors' Abstract

## Coke Desulfurization

Mason, R. B., Kimberlin, C. N., Jr., and Arey, W. F., Jr. (assigned to Esso Research and Engineering Co.), INTEGRATED FLUID COKE DESULFURIZATION PROCESS. U. S. 2,768,939 (1956) October 30.

High-sulfur coke from a petroleum fluid-coking system is desulfurized by contacting with hydrogen at 1200 to 1400° F. in a separate fluid-bed treating zone. Hydrogen sulfide is recovered from the treating zone off-gases, and the low-sulfur coke may be heated in a separate heating zone by oxidation with subsequent recirculation to the coking and hydrogenation zones. O. P. Brysch

## Coke Oven Charge Density

Throop, C. C., and Wince, O. V. (assigned to Koppers Company), BULK DENSITY CONTROL OF COKING COAL. U. S. 2,765,266 (1956) October 2.

Bulk density of the coal charged to coke ovens is controlled by feeding coal at a uniform rate by weight to a pulverizer, discharging pulverized coal at a uniform rate onto a moving conveyor belt, maintaining a constant height of coal on the belt with reference to a gage, by adding water (which reduces bulk density and increases height of belt coal) or oil (which increases bulk density). Manual or automatic regulation of oil and/or water additions may be used. O. P. Brysch

## Coke Strength

Friehmelt, E., BEITRAG ZUR KENNZEICHNUNG DER FESTIGKEITSEIGENSCHAFTEN VON KOKS. (CONTRIBUTION TO THE CHARACTERIZATION OF THE STRENGTH OF COKE.) *Brennstoff-Chemie* (German), 37, 292-301 (1956) October 17.

The importance of the strength of coke to the blast furnace industry is noted, and the development of the test methods (tumbler and shatter tests) is reviewed. Interpretation of tumbler results and their application in coke evaluation in Germany are given in great detail, and shortcomings of the various current "indexes" (drum-strength, abrasion, Ilseder No., Thibaut No., Graf No.) are indicated with graphs and tables. He complains that increase in number of pieces during tests, directly related to charge uniformity in the furnace, is not given proper consideration in these indexes.

O. P. Brysch

## Desulfurization

Doerges, A., NASSE GASENTSCHWFELUNG IN ENGLAND. (WET GAS DESULFURIZATION IN ENGLAND. *Gas- und Wasserfach* (German), 97, 893-96 (1956) November 1.

Supplements or improvements of the old dry cleaning of gas are the various wet desulfurization processes. One of them is the Collin-AS process used and industrially applied in Germany and England. The author reports about the neutralization operation with ammonia as an absorption medium and the experience of a plant operating in Corby, England, since 1952. Also the improvements made up to date and those planned for the near future are outlined. G. Kunst

Guntermann, W., NEUARTIGE H2S-ABSORPTION UND SCHWEFELGEWINNUNG AUS KOHLENSAEUREGASEN. (NEW H2S-ABSORPTION AND SULFUR RECOVERY FROM CARBON DIOXIDE CONTAINING GASES. *Gas- und Wasserfach* (German), **97**, 896-99 (1956) November 1.

In Larderello, Italy, volcanic water vapors are utilized to generate electric power. The unused residue of these vapors rich in carbon dioxide and H2S formerly was blown into the air. In order to recover 10,000 tons of sulfur annually thus discarded, a dry sulfur recovery plant was constructed. This plant is of interest to the gas specialists because of the operation and construction, despite the fact that it has no relation with the gas operation processes. The material-energy and maintenance cost as well as the wages with respect to the profit of the operation are discussed intensively. G. Kunst

Kernos, U., Brodskaya, N., and Teodorovich, V., COMPARATIVE STUDY OF GAS PURIFYING MATERIALS. *Gazovaya Promyshl. (Gas Industry)* (Russian), 9-13 (1956) October.

Laboratory tests were made on bog ores from the Leningrad and Tukanski areas, and on a byproduct from the Sterlitamakski soda plant, to determine their relative value as gas purifying materials. These materials were mixed with sawdust and water and then reacted with various mixtures of $H_2S$ and $O_2$ in inert gases. Eight curves are given which show the time rate of $H_2S$ sorption. Results showed that both the soda plant byproduct and the Tukanski ore had greater capacity per unit volume but lesser reaction velocity than the Leningrad ore. Their substitution for the Leningrad ore, which is now in general use, depends upon an economic study which will be made. J. W. Penney

Michaelis, P., NEUERE ERKENNTNISSE ZUR WIRTSCHAFTLICHEN AUSNUETYUNG DER GASREINIGUNGSMASSE BEI DER TROCKENEN GASENTSCHWEFELUNG. (NEW KNOWLEDGE ABOUT THE ECONOMIC USE OF THE GAS PURIFICATION "MASSE" IN DRY DESULFURIZATION). *Brennstaff-Chemie* (German), **37**, 323-31 (1956) October 17.

In dry desulfurization the operating cost depends primarily on the "masse" (or active iron sponge) consumption, and the savings upon the quality of the used-up "masse." The consumption and the enrichment of the mass have a set relationship to each other. The desulfurization is a catalytic $H_2S$-oxidation, the equilibrium of which is set by the molecular concentration of the reacting participants and the reaction pressure. The increase of the reaction velocity by raising the temperature with respect to the exothermic character of the transformation is only considered as a means to slow down the decrease of the activity which depends on the sulfur absorption. The decrease of activity limits the degree of desulfurization of gas and of mass-enrichment during the rough cleaning of the gas. The necessity to satisfy both requirements at the same time, namely gas desulfurization and sulfur buildup in the masse, sets a sulfur concentration gradient in the charge of "masse" and therefore a reaction which has a reasonable time of contact and stream velocity of the gas. The conclusions of the developed theory show agreement with the experimental results and operating experience of the author. The difficulties which arise during dry cleaning are explained and conditions leading to best performance for an economic utilization of the purification mass are made evident. G. Kunst

## Electro Tar Removal

Cooper, H. G., ELECTRO DETARRING. *Gas J.* (British), **288**, 108-9, 113-14 (1956) October 10.

Electro-precipitation is fundamentally a simple process, in which the basic principle is the removal of solid or liquid particles from a gaseous carrying medium by giving the particles an electrical charge and precipitating them on to a receiving surface in an electrical field. By plotting curves for tar fog removal against H. T. current in milliamps per electrode, per MMCF of gas passing, it was possible to calculate the efficiency of precipitation. On a basis of a throughput of one MMCF gas per day, for every milliamp H. T. current flow per MMCF per day of gas, one K.wh. is required; for every 1-in. pressure drop, four B.H.P. is required. The very approximate cost of physical means, therefore, is something like seven to ten times that of the electrostatic method,

and for conditions of high tar-fog removal, this factor is likely to be increased even more.

Author's Abstract

## Gasification

Chipman, J., NOTE ON THE PRODUCER GAS EQUILIBRIUM AND THE ENTROPY OF GRAPHITE, *J. Phys. Chem.*, **60**, 1467-68 (1956) October.

Data on the equilibrium constant for the reaction $CO_2$ (g) + C (graphite) = 2CO(g) are critically reviewed and summarized. Sources of error in experimental determinations are pointed out. The discussion covers results obtained over the period 1910-1947. The author concludes that the Bureau of Standards tabulations represent the best values for the equilibrium constant, and that inaccuracies which still exist make it unnecessary to postulate a zero-point entropy for graphite.

C. G. von Fredersdorff

THE TOTAL GASIFICATION OF POWDERED COAL. *Coke and Gas* (British), **18**, 437-41, 454 (1956) November.

A review with data and photographs is given of the Koppers-Totzek powdered coal gasifiers operated by the U. S. Bureau of Mines on a pilot scale at Louisiana, Missouri, and the commercial scale plant at Typpi-Oy, Finland, where the synthesis gas produced is used for ammonia production. The essential difference is that the U. S. Bureau of Mines unit operated near the coal ash-fusion temperature so that a small portion of the ash was actually slagged, whereas the Typpi-Oy plant operates at much lower temperatures (1200° C.) so that all the ash leaving the gasifier is dry. A large portion of the coal feed is ungasified, which results in the need for continuous recycling to improve the gasification efficiency.

C. G. von Fredersdorff

## Methanation

Altshuler, U. S., and Lebedev, V. V., PRODUCTION OF CITY GAS BY METHANATION OF WATER GAS. *Gazovaya Promyshl. (Gas Industry)* (Russian), No. 11, 17-21, 1956.

Laboratory tests were made with mixtures of pure CO and $H_2$, and with blue gas, to determine the practicability of methanation of blue gas to produce a city gas. The authors concluded that the process was feasible. Process includes production of blue gas, removal of sulphur compounds down to 0.08 grains/100 cf, reaction on a Ni-10% $Al_2O_3$ catalyst without conversion or hydrogen addition. Temperature regulation of catalyst is obtained by partial recirculation of gas through catalyst. Catalyst temperature 350° C., space velocity 6000 hours$^{-1}$, thermal yield 85%, volume of product gas per volume of blue gas 0.52, blue gas 291 Btu, product gas 476 Btu., product gas analysis 38.1% $CO_2$, 0.9% $O_2$, 1.9% CO, 5.9% $H_2$, 45.4% $CH_4$, 7.8% $N_2$.

J. W. Penney

## Reformed Gas

Hur, J. J., Deichler, H. K., and Worrell, G. R., BUILDING A CATALYTIC REFORMER? *Oil Gas J.*, **54**, 103-107 (1956) October.

Suggestions concerning the materials of construction for catalytic reformers are given with particular reference to hydrogen sulfide corrosion and operating temperatures.

H. L. Feldkirchner

Nelson, W. L., COMPOSITION OF GASES IN CATALYTIC REFORMING, *Oil Gas J.*, **54**, 118 (1956) October.

Compositions of catalytic reforming gases are given for eight different charge stocks, using a platinum catalyst.

H. L. Feldkirchner

## Sulfur Recovery

Conroy, E. H., Jr., Eads, D. K., and West, J. R. (assigned to Texas Gulf Sulphur Co.), CYCLIC PROCESS FOR RECOVERING SULFUR FROM HYDROGEN SULFIDE. U. S. 2,765,217 (1956) October 2.

The purpose of this invention is to recover the small amounts of sulfur compounds normally lost in the effluent gas from the Claus process. This is accomplished in combination with the patter process by burning the residual sulfur to sulfur oxides, absorbing the oxides in a liquid medium, and stripping the oxides from the medium with air or an oxygen-containing gas which is then used for combustion in the Claus process.

D. M. Mason

## 5. NATURAL GAS AND NATURAL GAS CONDENSATES

### Aluminum Piping

ALUMINUM TAKES BOLD STEPS INTO OIL. *Petrol. Week,* 3, 13, 15-17 (1956) October 5.

A summary of the uses of aluminum in the oil industry. Sections on the use of aluminum in drilling and production processing and pipelining are included. Some of the disadvantages of aluminum for oil field use are also briefly considered. G. G. Wilson

### Compression

Gilmore, W., Jr., PGW ADDS COMPRESSOR TO DISTRIBUTION SYSTEM. *Gas,* 32, 43-47 (1956) December.

Station A of the Philadelphia Gas Works Division of U.G.I. began operation on December 8 of a new 2000 hp gas-engine driven angle compressor capable of pumping 1.3 MMCF/hr at 25 psig. A new building houses the compressor and auxiliaries, with provision for enlargement for six machines. Station A has in addition 5320 hp of engine and 5480 hp of steam turbine compressors. Also Station B has 12500 hp of engine and 7260 hp of turbine compressors, and the holder stations have 7045 hp of pumping capacity. These units serve 600,000 customers in a 129 sq mile area with 720 Btu mixed gas (natural, reformed natural, modified natural, coke oven and water gas), with a 1955 peak send-out day of 162.7 MMCF. O. P. Brysch

### District Regulation

Herking, P. W., and Myers, H. R., STANDARDIZATION AND PREFABRICATION OF DISTRICT REGULATOR INSTALLATIONS. *Gas,* 32, 48-53 (1956) December.

Designs are described for two basic standardized district pressure regulator installations in use by the Cincinnati Gas and Electric Co. Illustrations and drawings are presented for the two types (sidewalk and street) of these prefabricated units, which are assembled, tested, adjusted and hauled to the site, where the concrete vault is quickly poured and connecting lines are welded. Much saving in cost of installation, operation and maintenance has resulted, while meeting code safety requirements. O. P. Brysch

Moxley, W. M., PEAK LOAD MEDIUM PRESSURE DISTRIBUTION SYSTEMS. *Gas World* (British) 144, 704-06 (1956) October 6.

The use of increased pressure during the peak load periods to increase the capacity of a low-pressure distribution system is advocated. This increased operating pressure level is accomplished by use of a pressure booster in conjunction with clock-controlled district governors and service regulators. Several examples of the savings which can be affected by this type of operation are included. G. G. Wilson

### Drilling

Bentson, H. G., MODERN DRILLING: ROCK-BIT SELECTION, AND EVALUATION—PART 10. WHAT HARDFACING CAN DO FOR ROCK-BIT TEETH. *Oil Gas J.,* 54, 145-46 (1956) December 10. PART 11. WHY ARE BIT-DESIGN FACTORS IMPORTANT? *Oil Gas J.,* 54, 82, 83 (1956) December 24.

In Part 10, the use of tungsten carbide hard facings is discussed with respect to the design of roller rock bits. Gage surfaces usually are so protected, but tooth surface facing will vary with the formation characteristics. Self sharpening is obtained by facing one side only. General design of bits depends on the rock formation, and ten types (A to K) are tabulated to show agreement of comercially available bits among six manufacturers. Part 11 of the series describes briefly, with illustrations, the design factors of the first five types of 3-cone bits. Combinations of factors vary with the rock formation to be drilled, thus: Type A, for softest rock, has smallest journal angle, largest offset, greatest cone profile variation, and widest spaced, maximum depth teeth; Type B, for soft to medium, or soft with streaks, resembles A but has shallower, more closely-spaced teeth; Type C, for soft to medium formation with hard streaks, resembles A and B except for more teeth, shallower and closer spaced; Type D, for medium rock, has maximum journal angle, medium offset and lower cone profile variation, than A, B and C, with heavier, shallower and more closely spaced teeth with deletions; for medium hard rock, Type E is identical to D, but deletions are omitted. O. P. Brysch

O'Connor, J. B., and Meyer, M. D., TURBODRILLS FOR AMERICAN DRILLING. *Monitor*, 1, 2-4, 46 (1956) November.

The author reviews the history of turbodrilling and the many efforts made before the successful French and Russian models were developed.
R. T. Ellington

Burgess, G., CORE RECOVERY APPARATUS. U. S. 2,769,615 (1956) November 6.

Eckel, J. E., and Boucher, F. G. (assigned to Esso Research and Eng. Co.), ENLARGING BORE HOLES BY PELLET DRILLING. U. S. 2,771,269 (1956) November 20.

Hildebrandt, A. B. (assigned to Esso Res. and Eng. Co.), RECYCLE FLUID CONTROL IN PELLET IMPACT DRILLING. U. S. 2,771,-274 (1956) November 20.

Hughes, J. R., METHOD OF PREVENTING THE LOSS OF DRILLING MUD. U. S. 2,768,-693 (1956) October 30.

Morlan, E. A., and Woods, H. B., PREVENTION OF MUD CUTTING IN EARTH BORING DRILLS. U. S. 2,769,616 (1956) November 6.

Neal, S. A., CIRCULATING AND ROTATING RETRIEVABLE WHIPSTOCK. U. S. 2,770,-444 (1956) November 13.

Ortloff, J. E. (assigned to Esso Research and Eng. Co.), HARD FORMATION RETRACTABLE DRILL BIT. U. S. 2,771,275 (1956) November 20.

Selberg, J. P., and Currie, G. D. (assigned to Borg-Warner Corp.), EARTH BORING APPARATUS. U. S. 2,771,270 (1956) November 20.

## Equilibria

Lu, B. C.-Y., PREDICTION OF VAPOR-LIQUID EQUILIBRIUM DATA FOR BINARY HYDROCARBON MIXTURES AT VARIOUS TOTAL PRESSURES. *Amer. Inst. Chem. Eng. J.*, 2, 525-28 (1956) December.

An empirical method is suggested which permits the prediction of vapor-liquid equlibrium data at one constant pressure. This method has been tested with the vapor-liquid equilibrium data of six non-ideal systems measured at twenty-one different experimental conditions. The total pressure range varies from 50 mm. of mercury to 4 atm. In all cases the predicted results are in good agreement with the experimental data.
Author's Abstract

## Gas Fractionation

Kapfer, W. H., Malow, M., Happel, J., and Marsel, C. J., FRACTIONATION OF GAS MIXTURES IN A MOVING-BED ADSORBER. *Amer. Inst. Chem. Eng. J.*, 2, 456-467 (1956) December.

The design and operation of a pilot-scale-moving bed adsorber to separate the various components of a gas mixture using activated carbon as the preferential adsorbent are described. A binary system, methane-acetylene, and a ternary system, methane-carbon dioxide-acetylene, were studied. The performance of the unit was analyzed by means of the transfer-unit-height (H.T.U.) concept based on the observed changes in gas composition during tower operation. For both the binary and ternary systems the transfer-unit height was independent of feed-gas composition but was found to vary linearly with the ratio of feed gas to carbon flow. The over-all transfer-unit-height values based on either the gas or the adsorbed phase were observed to vary from 6.5 in. at 1.39 cu ft/lb. carbon to 36.9 in. at 4.81 std. cu ft/lb. carbon.
Authors' Abstract

## Gas Industry Future

Tippy, W. B., WHERE DOES THE GAS INDUSTRY GO FROM HERE? Amer. Gas Assoc., Opertg. Sect. Paper OS-56-4, (1956) October 15; *Amer. Gas J.*, 183, 65-69 (1956) October.

Statistics are presented in graphical form, with projections to the year 2000 for U. S. population, total energy output, per capita energy consumption, energy utilization efficiency, relative energy uses, breakdown of percentage of total energy supplied by the various fossil fuels and nuclear energy, natural gas and petroleum production and the relative importance of coal as major contender for the energy supply market. The important aspects as far as the natural gas industry is concerned are the forecasts that indicate a peak of natural gas producibility should occur between 1970 and 1975, followed by a steady decline thereafter, and that a peak of petroleum production is expected in

this same time range. The deficit of gas and oil by 1975 and thereafter is expected to be alleviated in part by synthetic production and by imports. The latter are expected to decline however. These predictions are based on ultimate reserves of gas of 850,000 and 1,000,000 trillion Btu, and of petroleum of 1,100,000 trillion Btu. The distribution as per cent of total energy in the U. S. A. in 1955 shows natural gas supplies 23%, petroleum 43%, coal 28%, wood 5%, and hydroelectricity 1%. The anticipated figures by 1980 are natural gas 17%, petroleum 30%, synthetic oil and gas 10%, coal 33%, nuclear power 5%, wood 4% and hydroelectricity still approximately 1%, followed by still further changes in the energy proportions so that in the year 2000 the projected percentages are natural gas 4%, petroleum 13%, synthetic oil and gas 21%, coal 32%, nuclear power 25%, wood 3% and hydroelectricity perhaps up to 2%. The total energy output of the U. S. A. is expected to double by 1980 and triple by 2000 A.D. (See also Gas Abs 12, 173 (1956) October.)

C. G. von Fredersdorff

## Insert-Ring Welding

Thielsch, H., CONSUMABLE SOLID INSERT RINGS IMPROVE PIPE WELDING QUALITY. *Heatg., Pipg., Air Condg.*, 28, 101-03 (1956) October.

A summary of the advantages of the use of solid metal rings inserted between adjoining pipe-sections to be welded together. Practise in using these rings is also presented.

G. G. Wilson

## Logging

Castel, J. H., and Waters, H. C. (assigned to Perforating Guns Atlas Corp.) WELL PERFORATING AND LOGGING METHODS AND APPARATUS. U. S. 2,768,684 (1956) October 30.

Cooley, E. H. (assigned to Stanolind Oil and Gas Co.), DETECTING CORROSION OF WELL CASING. U. S. 2,770,773 (1956) November 13.

Schuster, N. A. (assigned to Schlumberger Well Surveying Corp.), WELL LOGGING METHODS AND APPARATUS. U. S. 2,770,771 (1956) November 13.

Summers, G. C. (assigned to Socony Mobil Oil Co.), MUD CORRECTION FOR VELOCITY WELL LOGGING. U. S. 2,768,701 (1956) October 30.

## LP-Gas Sales

Benz, G. R., Tucker, P. W., and DeVoe, W. F., LP-GAS SALES SHOW FIRST BILLION GALLON INCREASE. *Butane-Propane News*, 19, 30-34 (1957) January; *Oil Gas J.*, 55, 92 (1957) January 7; *Gas Age*, 119, (I) 42-5 (1957) January 10; *Amer. Gas Assoc. Monthly*, 39, 9, 10, 26 (1957) January; *Chem. Eng. News*, 35, 124 (1957) January 7; *Petrol. Week*, 4, 13 (1957) January 4.

The increase in LP-gas sales of 1,001 million gal. (16.7%) during 1956 has brought the total to 6,997 million gal. General markets for LP-gas increased 17.8% to 4,068 million gal. for domestic fuel and motor fuel; 20.1% to 1,642 million gal. for chemical manufacturing; 10.4% to 614 million gal. for industrial and miscellaneous uses; 8.1% to 439 million gal. for rubber components; and 9.5% to 234 million gal. for gas manufacturing. Production capacity has been increased 1,120 mil gal/day by 26 new plants, and of the total production about 75% is now coming from natural gasoline plants. Underground storage facilities now are estimated at almost 1 bill. gal. Four new pipelines and 1 tanker were planned or under construction, and 22,000 tank cars were in service.

O. P. Brysch

## LP-Gas Motor Fuel

Reber, D., LP-GAS CARBURETION EQUIPMENT. *LP-Gas*, 16, 65-9 (1956) October.

A comparison is given between LP-gas and gasoline, when used as motor fuels. Advantages such as vaporization rate, high octane value, and systems and equipment are briefly discussed.

O. P. Brysch

LPG-ENGINE FUEL AND LUBRICANT REQUIREMENTS. *Lubrication*, 42, 133, 148 (1956) November.

LPG is not new. The lighter hydrocarbons that are normally gases at atmospheric pressure and above freezing temperatures have been used for years as sources of heat—even in internal combustion engines. Although commercial butane and commercial propane used in automotive engines are considered to be similar to

gasoline except for methods of handling, a review of their characteristics reveals enough differences to warrant engine modifications to utilize the fuel best. These characteristics and their effect on engine performance are discussed. A review of engine factors and actual test results indicates that consideration should be given to the motor oil used on LPG engines. Motor oil recommendations are included.

Authors' Abstract

## Offshore Operations

OUT IN THE GULF FOR GAS. *Gas*, 32, 118, 121, 122 (1956) December.

The joint offshore drilling operations of the Union Producing Co. (United Gas Corp.) and Shell Oil Co. in Block 128 of the Eugene Island (La.) area are described briefly and illustrated. Platforms "A" and "B," both producing, are in 50-ft water 30 miles offshore. O. P. Brysch

## Remote Control

LoChiano, R., WHY GULF INTERSTATE IS GOING TO "SATELLITES." ASME Petroleum Mech. Eng. Conf. Paper 56-PET-22, Dallas, Sept. 23-6 (1956). *Pipe Line Ind.*, 5, 34-38 (1956) November; *Gas*, 32, 109, 110, 113, 114, 117 (1956) December.

Unattended operation of the Stanton, Kentucky, station points the way to reduce costs with safety and dependability. Four new stations will follow the pattern. Author's Abstract

## Reservoir Flow

Corey, A. T., Rathjens, C. H., Henderson, J. H., THREE-PHASE RELATIVE PERMEABILITY. *J. Petrol. Techn.*, 8, 63-65 (1956) November.

The results of three-phase relative permeability tests on nine water-wet consolidated Berea sandstone samples are presented as composite ternary diagrams showing isoperms of oil, water and gas. Capillary pressure control was exercised over the flow of gas and oil in the presence of water. The water saturations ranges from 17 to 71 per cent pore volume. A method of calculating both the oil and water permeabilities of a three-phase system from the easily measured gas relative permeability is presented. Authors' Abstract

Hubbert, M. K., DARCY'S LAW AND THE FIELD EQUATIONS OF THE FLOW OF UNDERGROUND FLUIDS, *J. Petrol. Technol.*, 8, 222-239 (1956) October.

This paper reviews the experimental basis of Darcy's law and discusses the meaning of his results by direct derivation from the Navier-Stokes equation of motion for viscous fluids. The author resolves various common misconceptions concerning the nature of Darcy's law.

R. F. Bukacek

Hunt, E. B., Jr., and Berry, V. J., Jr., EVOLUTION OF GAS FROM LIQUIDS FLOWING THROUGH POROUS MEDIA. *Amer. Int. Chem. Eng. J.*, 2, 560-67 (1956) December.

The production of oil and gas by pressure depletion involves both the formation of bubbles and the diffusion of gas from the liquid phase into these bubbles. Studies were undertaken to outline in detail the process of bubble formation when the driving force is small. This work shows that the formation of bubbles is a random process which can, however, be described by a simple probability distribution function. Also, calculations have been made to determine how fast gas will diffuse into uniformly distributed gas bubbles. These results make it possible to describe the manner in which a gas phase is established during the pressure depletion process. In this process the rate of pressure decline is the most important factor influencing the total number of bubbles produced. Laboratory tests have substantiated the finding that in certain types of porous media the amount of oil recovered is sensitive to the number of bubbles formed.

Authors' Abstract

Stutzman, L. F., and Thodos, G., ADAPTATION OF FRICTION FACTORS THROUGH CONSOLIDATED FORMATIONS. *J. Petrol. Techn.*, 8, 59-62 (1956) November.

The friction factor plot presented by Cornell and Katz is developed for the flow of fluids through consolidated flow. In this adaptation the friction factor plot is used directly for the solution of problems and thereby eliminates the use of the conventional equations which are specific to laminar (Darcy) or turbulent flow. This approach overcomes the disadvantages inherent in the use of these conventional equations. It eliminates the necessity of checking the type of flow occurring in order to identify the specific equation which must be used. In

radial flow problems, because of the increasing mass velocity of the fluids as they approach the wellbore, the type of flow may no longer remain laminar. Consequently, it is necessary to use more than one equation in a problem and to identify the range over which each equation should be applied. Finally, in practice it has been found that much of the flow of gases through consolidated media occurs in a range that is neither laminar or turbulent. For this transitional region, no convenient equations are available. The method and presented friction factor plot are applicable to both liquids and gases. Authors' Abstract

### Well Practise

Stekoll, M. H., FRACTURING THROUGH PERFORATIONS. *Oil Gas J.* 54, 95-97 (1956) October 29.

Hydraulic fracturing through perforations is much different from fracturing in open hole. Perforations act as a number of pressure-relief valves, each set to open at a different pressure. Only a few of the perforations that will fracture at the lowest pressures may take all the fluid injected, leaving the rest unaffected. This makes rate of injection a very important variable in fracturing. Author's Abstract

### Well Practise

Clark, R. C., Jr. (assigned to Stanolind Oil and Gas Co.), SAND CONSOLIDATION. U. S. 2,770,306 (1956) November 13.

Deardoff, T. J. (assigned to Parafrac, Inc.), PARAFFIN REMOVAL PROCESS FOR OIL WELLS. U. S. 2,770,307 (1956) November 13.

Huber, T. A. (assigned to Esso Research and Eng. Co.), APPARATUS FOR SQUEEZE CEMENTING WELL PERFORATIONS. U. S. 2,771,141 (1956) November 20.

McKissick, W. H., and Fate, J. E. Jr., TUBING ANCHOR. U. S. 2,769,499 (1956) November 6.

Reistle, C. E. (assigned to Esso Research and Eng. Co.), METHOD FOR TREATING HYDROCARBON PRODUCING FORMATIONS. U. S. 2,769,497 (1956) November 6.

Saurenman, D. F. (assigned to Schlumberger Well Surveying Co.), BOREHOLE APPARATUS OPERATED BY THE WELL FLUID. U. S. 2,770,308 (1956) November 13.

Sloan, O. C., and Gibbs, J. W., TUBING DRAINS. U. S. 2,771,142 (1956) November 20.

Whitehill, A. J., DIRT GUARDS. U. S. 2,770,-309 (1956) November 13.

## 6. PETROLEUM AND SYNTHETIC LIQUID FUELS

### Cracking Catalysts

Innes, W. B., POROSITY AND DENSITY OF CRACKING CATALYSTS. *Oil Gas J.*, 54, 162-66 (1956) November 12.

Porosity and the related quantity, particle density, are perhaps the two most important physical properties of a catalyst. Porosity affects catalyst stability, stack losses, product distribution, carbon-burning properties, stripping, circulation, and catalyst fluidization. The ways in which these various operating factors vary with porosity may be determined at least qualitatively. It is then possible to establish permissible porosity variations from these relationships. Pore volume, a direct measurement of porosity, may now be determined on a routine basis by a new, recently developed method. The method is further adapted to the determination of skeletal and particle density. Author's Abstract

Wilson, W. B., Good, G. M., Deahl, T. J., Brewer, C. P., and Appleby, W. G., COMMERCIAL PERFORMANCE OF FLUID CRACKING CATALYSTS—A NEW TECHNIQUE OF STUDY. *Ind. Eng. Chem.*, 48, 1982-89 (1956) November.

In commercial fluid cracking units operating on synthetic silica alumina catalyst, fresh catalyst is added to the process continuously. The rate of fresh catalyst addition is usually greater than that required to replace catalyst fines lost. The rest of the addition is withdrawn along with older catalyst to maintain a constant inventory and the remainder undergoes deactivation as a small part of the large masse of the circulating inventory. The process leads ultimately to an equilibrium catalyst inventory. The paper reports on the surface area and pore volume of a change of catalyst as it enters and

passes through and out of a commercial fluid cracks. The summary of the results is as follows: Roughly 75% of the surface area and 50% of the pore volume of the fresh catalyst are lost during the 24-hour period in which it is added to the unit. Subsequently the deactivation rate is much slower. During this period the loss in surface area is more rapid than the loss in pore volume. There is a gradual and steady closing off of the catalyst pore volume (formation of trapped voids), which renders part of the pore volume inaccessible to the flotation medium used to effect a separation according to particle density. The trapping of voids, however, in the commercial unit studied plays a minor role in the over-all deactivation of the catalyst; only the oldest catalyst in the inventory contains a significant amount of trapped voids. H. A. Dirksen

## Energy from Petroleum

Platt, J. W., THE OIL INDUSTRY — ITS PLACE IN THE WORLD AND ITS FUTURE. *J. Inst. Petroleum* (British), 42, 217-27 (1956) August.

A survey is given of total world energy requirements, with a breakdown of the percentages expected to be supplied by oil, coal and atomic energy in the future. A summary of oil production and proven reserves shows that while both figures have increased rapidly over the past decade, the ratio of proven reserves to production has not changed significantly. By applying foreseeable rates of annual consumption, the proven oil reserves would be exhausted by 1975, if no new sources were discovered. Although proven world reserves amount to some 170,000 million bbl, estimates of recoverable reserves are 3 to 6 times this figure, ranging from 485,000 million bbl estimated in 1945, 600,000 million bbl estimated in 1954, and with speculation on the amounts contained in the continental shelves, estimated world reserves could be in excess of 1,000,000 million bbl. It is foreseen that the U. S. A., with oil requirements rising at approximately 4%/year, will by 1965 reach a consumption of 13 million bbl/day, of which approximately 25% would have to be imported. It is anticipated that world capital investment in petroleum will nearly double by 1965. C. G. von Fredersdorff

## Isomerization

ISOMERIZATION OF NORMAL PARAFFINS. *Petrol. Processing*, 11, 101-3 (1956) October.

The Atlantic Refining Company's Pentafining process, employing a fixed-bed catalytic process to isomerize low-boiling paraffins (normal pentane, hexane and heptane) to isoparaffins, is described. The catalyst, a combination of platinum, silica and alumina, may be regenerated in place. H. L. Feldkirchner

## Oil Consumption

Willets, H., OIL USE TO INCREASE FURTHER IN 1957. *World Oil*, 143, 77-79 (1956) November.

Late estimates indicate that U. S. consumption of oil will average 9,246,000 bbl per day in 1957. This is an increase of 4.3% over the 1956 consumption. World sales outside the U. S. are also expected to rise. W. G. Bair

## Oxo Reaction

Krebs, R. W., and Catterall, W. E. (assigned to United States of America), OXO PROCESS. U. S. 2,768,974 (1956) October 30.

This improvement of the Oxo process, which has been assigned to Esso Research and Engineering Company, involves the addition of water-soluble catalyst at intermediate points throughout the reaction zone in order to avoid flooding the reactor and quenching the reaction. H. L. Feldkirchner

## Secondary Recovery

Barclay, H. A., and Nichols, Dean P. (assigned to Socony Mobil Oil Co., Inc.), SUBSURFACE IGNITER. U. S. 2,771,140 (1956) November 20.

Beeson, D. M. (assigned to Esso Research and Engineering Co.), WATERFLOODING METHOD OF SECONDARY RECOVERY. U. S. 2,771,138 (1956) November 20.

Burton, M. B., Jr., and Crawford, P. B. APPLICATION OF THE GELATIN MODEL FOR STUDYING MOBILITY RATIO EFFECTS. T.N. 369 *J. Petrol. Techn.*, VIII, 63-67 (1956) October.

A procedure is given which describes how the gelatin model may be used to study the effect of mobility ratio on areas swept before and

after breakthrough in fluid injection programs. Differences in mobility ratio are achieved through the proper selection of electrolytes for the invading and displaced fluids. The progress of the front is followed visually and photographed or traced onto plates as desired positions before and after breakthrough. Example applications to standard flooding patterns, vertically and horizontally fractured reservoirs and the in-situ combustion recovery process are presented. Authors' Abstract

Johnson, E. F., and Binder, G. G. (assigned to Esso Research and Engineering Co.), MULTIPLE SOLVENT SECONDARY RECOVERY PROCESS. U. S. 2,771,139 (1956) November 20.

Rintoul, W. T., THERMAL RECOVERY EXPERIMENTS. *Indep. Petr. Assoc. Amer. Monthly*, 27, 46, 48 (1956) October.

Two important experiments in applying thermal recovery techniques commercially are in progress within thirty miles of each other in California's San Joaquin Valley. General Petroleum Corporation and Standard Oil of California are operating the tests, which are being followed with interest by the other major producers. The experiments are described in considerable detail. B. E. Eakin

## 7. ANALYTICAL METHODS AND TESTS

### Carbon and Hydrogen

McCoy, R. N., and Bastin, E. L., DETERMINATION OF CARBON AND HYDROGEN IN ORGANIC FLUORINE COMPOUNDS. *Anal. Chem.*, 28, 1776-80 (1956) November.

A conventional microcombustion procedure for the determination of carbon and hydrogen was frequently found unsatisfactory for the successive analysis of highly fluorinated organic materials. A modified combustion tube filling, maintained at 900° C. and containing two sections of magnesium oxide separated by a section of copper oxide, ensures complete oxidation of the sample and removal of fluorine from the combustion products. The precision found was somewhat better for hydrogen and somewhat poorer for carbon than that for the nonfluorinated samples using a conventional procedure. Because the apparatus includes a system for measuring and transferring gaseous samples to the combustion tube, it can thus be used for samples ranging from gases to solids.

Authors' Abstract

### Gas Hydrocarbons

Roberts, A. L., Towler, J. H., and Holland, B. H., THE HYDROCARBON CONTENT OF FUEL GASES. Gas Council (British) Research Comm. GC31 (1956) November 20; *Gas J.* (British), 288, 547, 551-3, November 28; 609,-610 (1956) December 5; *Gas World* (British), 144, 1069, November 24; 1316-18 (1956) December 29.

Results of a detailed analysis of the hydrocarbons present in manufactured fuel gases is presented. Gases from a horizontal retort, intermittent vertical chamber oven, coke oven, continuous vertical retort, low temperature retort, carbureted water gas plant, and a catalytic "Segas" plant were examined. Analyses of the sulfur compounds in these gases are also reported. D. M. Mason

### Sample Preparation

Barker, J. E., Mott, R. A., and Thomas, W. C., MIXING OF THE "ANALYSIS" SAMPLE OF COAL OR COKE. *Fuel* (British), 35, 493-500 (1956) October.

The superiority of the B.C.R.A. laboratory mixer, which gives efficient mixing in one minute, over the Bureau of Mines mixing wheel and the Quickmix, is demonstrated. A manufacturer's prototype of the B.C.R.A. laboratory mixer has been standardized, and this work has led to a minor modification of the design and to information about the critical factors of the design. The advantage to be gained by the use of an efficient mixer for the "analysis" sample is shown for determinations of ash and sulfur by a lower variance of analysis of a lower range for duplicate determinations.

Authors' Abstract

Mott, R. A., and Thomas, W. C., THE PREPARATION OF GROSS SAMPLES OF COAL FOR GENERAL ANALYSIS: MILLING, SAMPLE-DIVISION AND MIXING. *J. Inst. Fuel* (British), 29, 410-417 (1956) October.

The procedures found suitable for sampling of coke for general analysis were applied to sampling of low and high-ash coals. Decrease in the specified upper grain-size on the ground

sample, use of a rotary sample divider (instead of riffles) and use of a mechanical rotary sample mixer before dividing have been found necessary to reduce the variance to a low value for coals. Methods and equipment of the British Coke Research Association have been found effective. O. P. Brysch

### Sulfur and Phosphorus

Gerhardt, P. B., and Dryoff, G. V., RAPID METHOD FOR SIMULTANEOUS DETERMINATION OF SULFUR AND PHOSPHORUS IN PETROLEUM PRODUCTS. *Anal. Chem.*, 28, 1725-30 (1956) November.

An extension of the high temperature combustion technique permits the rapid determination of sulfur and phosphorus in the same sample in an elapsed time of about 20 minutes. The sample, mixed with zinc oxide, is burned in a high temperature unit. The sulfur dioxide evolved is absorbed in an acid-iodide solution and the sulfur determined by immediate titration with potassium iodate. The residue of zinc phosphates in the combustion boat is dissolved and the phosphorus determined colorimetrically as molybdivanado phosphoric acid. The estimated standard deviation of the phosphorus test is about 0.02 above the 0.1% level and 0.003 below the 0.1% level. Authors' Abstract

### Unsaturated Hydrocarbons

Leisey, F. A., and Grutsch, J. F. TRACE UNSATURATION OF HYDROCARBONS BY COULOMETRIC TITRATION. *Anal. Chem.*, 28, 1553-5 (1956) October.

Trace unsaturation of hydrocarbons is frequently measured by bromine addition in the petroleum industry. In a new technique for measuring unsaturation, olefins are titrated with coulometrically generated bromine and the end point is detected amperometrically. The time of titration is proportional to the bromine alled to the sample. Better than 0.5% agreement with theoretical values for synthetic samples has been obtained over a bromine index range of 0 to 180. The method is rapid, accurate, and well suited for routine use. Authors' Abstract

## 8. GENERAL AND PHYSICAL CHEMISTRY

### CO Oxidation

Ritchey, W. M., and Calvert, J. G., THE PHOTOSENSITIZED OXIDATION OF CARBON MONOXIDE ON CUPROUS OXIDE. *J. Phys. Chem.*, 60, 1465-67 (1956) October.

Photosentization of the oxidation of CO on $Cu_2O$ has been observed in this work. Significant evidence has been obtained for the importance of electron-reactant interaction at the $Cu_2O$ surface in a rate-determining step of the reaction. Authors' Abstract

### Hexenes

Camin, D. L., and Rossini, F. D., PHYSICAL PROPERTIES OF THE 17 ISOMERIC HEXENES OF THE API RESEARCH SERIES. *J. Phys. Chem.*, 60, 1446-51 (1956) October.

For the isomeric hexenes, highly purified hydrocarbons of the API Research series, the following properties were measured: densities at 20, 25 and 30°, refractive indices at seven wave lengths at 20, 25 and 30° and boiling points and vapor pressures at 80 to 780 mm. The data on refractive indices were correlated by means of modified Cauchy and Hartmann equations, and values of the constants are given for each compound, to permit precise evaluation of the refractive index as a function of wave length. The data on vapor pressures were correlated with the Antoine equation and values of the three constants are given for each compound. Also included are calculated values of the specific dispersions, (nF-nc)/d and nG-nD/d, and of heats of vaporization at 25° and the normal boiling point. Authors' Abstract

### Hydrocarbon Viscosity

Lohrenz, J., FINDS ABSOLUTE VISCOSITY BY NOMOGRAPH. *Petroleum Ref.*, 35, 169-170 (1956) November.

A nomograph is presented for the determination of absolute viscosity versus temperature for liquid hydrocarbons up to 20 carbon atoms. The author states that the nomagraph yields viscosities within a maximum error of 5% (based upon API Project 44 viscosity data) from the melting to the normal boiling point. Twenty-five hydrocarbons are placed on the

nomograph, however, the author believes that other hydrocarbons can be placed from two known viscosity-temperature pairs except for alkyl aromatics of more than 12 carbon atoms in the alkyl group. N. D. Smith

## Lithium Salt Hydrates

Campbell, A. N., and Griffiths, J. E., THE SYSTEM LITHIUM CHLORATE-LITHIUM CHLORIDE-WATER AT VARIOUS TEMPERATURES, *Canad. J. Chemistry*, 34, 1647-1661 (1956) November.

The equilibrium diagram of the system lithium chlorate-water has been determined at all temperatures and that of the system lithium chlorate-lithium chloride-water at the temperatures 3.0°, 6.0°, 8.5°, and 25.0° C. Lithium chlorate forms three hydrates having the formulae: (i) $(LiClO_3)_4.H_2O$—stable in contact with solution from 20.5° to 42.0° C. (ii) $LiClO_3.H_2O$—stable in contact with solution from—0.1° to 20.5° C. (iii) $LiClO_3.3\ H_2O$—melts congruently at 8.4° C. Hydrate (i) was discovered by Berg, but he gave to it the formula $(LiClO_3)_3.H_2O$. Lithium chlorate and lithium chloride form no double salts at the temperatures of investigation. Lithium chlorate exists in two enantio-tropic forms, namely the alpha and the beta forms. The transition beta, takes place at 99.8° C. and the alpha form has the lower density. The gamma form, proposed by Kraus and Burgess, does not exist either stably or metastably. The X-ray diffraction pattern of beta-$LiClO_3$ has been obtained. Authors' Abstract

## Metal Carbonyls

Cotton, F. A., Fischer, A. K., and Wilkinson, G., HEATS OF COMBUSTION AND FORMATION OF METAL CARBONYLS. I. CHROMIUM, MOLYBDENUM AND TUNGSTEN HEXACARBONYLS, *J. Am. Chem. Soc.*, 78, 5168-71 (1956) October 20.

The heats of combustion of $Cr(CO)_6$, $Mo(CO)_6$ and $W(CO)_6$ have been determined by direct calorimetric measurement. The values calculated for $\Delta Hf_{298}$ of the solid carbonyls are, respectively, −257.5, −234.8 and −227.2 kcal./mole. Sources of error are discussed and the results compared with those recently reported by Russian workers. Authors' Abstract

## Organic S Breakdown

Haines, W. E., Cook, G. L., and Ball, J. S., GASEOUS DECOMPOSITION PRODUCTS FORMED BY THE ACTION OF LIGHT ON ORGANIC SULFUR COMPOUNDS. *J. Amer. Chem. Soc.*, 78, 5213-5215 (1956) October 20.

Exposures of 30 highly purified sulfur compounds to a mercury-vapor light under identical conditions produced gaseous decomposition products that were analyzed mass spectrometrically. The experiments included 13 thiols, 8 sulfides, 3 cyclic sulfides, 2 disulfides and 4 thiophenes. Decompositions, as measured by the gaseous products, ranged from 0.004 to 3.0 mole %. Thiols showed greater amounts of decomposition than the other types of sulfur compounds and gave hydrogen as the main product. Sulfides and disulfides yielded, as the predominant product, a saturated hydrocarbon corresponding to the smallest alkyl radical attached to the sulfur. Thiophenes gave hydrogen and hydrogen sulfide. These experiments show that the sulfur compounds studied must be protected from light to maintain high purity. Authors' Abstract

## Process Efficiency

Denbigh, K. G., THE SECOND-LAW EFFICIENCY OF CHEMICAL PROCESSES. *Chem. Eng. Science*, 6, 1-9 (1956) October.

Equations are developed for calculating the thermodynamic efficiency of a chemical manufacturing process, using as a basis for the efficiency the second law, rather than a simple energy balance. This requires a consideration of the temperature at which heat is recovered, as well as the amount recovered and involves the use of the "availability" function, as developed by Keenan. The thermodynamic efficiency of a typical ammonia oxidation process is shown to be about 6%, or is 11% when prescribed conditions of irreversibility are allowed for. By contrast the ordinary thermal efficiency, based on the first law, is as high as 32%. Author's Abstract

## Thermal Diffusion

Thomas, W. J., and Watkins, S. B., THE SEPARATION OF MULTICOMPONENT MIXTURES OF COMMON GASES BY THERMAL DIFFUSION, *Chem. Eng. Science*, 6, 26-34 (1956) October.

Since the existing theory on the separation of

gases by thermal diffusion is inadequate to predict practical results, an investigation was made on the separation of common gases such as CO and $H_2$ mixtures by the heated-wire technique. It was demonstrated that the separation can be greatly improved by the addition of a third component, namely $CO_2$, the action of which, it is theorized, is to sweep by virtue of its greater density difference, the heavier component CO toward the bottom of the thermal column. Tabulated results are given which indicate that the third component effect on the separation ratio reaches a maximum and then decreases at $CO_2$ concentrations above 10% in the initial gas mixture. The method of thermal diffusion appears applicable to the separation of radioactive isotopes.

C. G. von Fredersdorff

## 9. ORGANIC CHEMISTRY

### Acetylene

Breitmayer, T. (assigned to Monsanto Chemical Co.), ACETYLENE HANDLING. U. S. 2,770,323 (1956) November 13.

This improved process for recovering acetylene produced from hydrocarbons involves subsequent storage of the purified acetylene in liquid solution. H. L. Feldkirchner

Pichler, H. R., and Chervenak, M. C. (assigned to Hydrocarbon Research, Inc.). PRODUCTION OF ACETYLENE AND REACTOR THEREFOR. U. S. 2,765,358 (1956) October 2.

A method and apparatus are given for the production of acetylene by partial oxidation of a gaseous or vaporized hydrocarbon. Design of the equipment allows the reactants to be preheated to an elevated temperature prior to entering the reaction zone without the danger of pre-ignition. Pre-ignition is avoided by bringing the preheated reactants together in a non-catalytic mixing zone and passing them through a porous barrier before they enter the reaction zone. H. L. Feldkirchner

Pichler, H. R., and Chervenak, M. C. (assigned to Hydrocarbon Research, Inc.). PRODUCTION OF ACETYLENE. U. S. 2,765,359 (1956) October 2.

A device and method are described whereby acetylene may be produced continuously from a gaseous hydrocarbon by partial oxidation using commercially available oxygen. The equipment is so designed as to prevent the formation of carbon in the reaction chamber and preignition of the preheated reactivity in the mixing zone. Preignition is avoided by eliminating metal from the mixing zone, while flashbacks from the reaction zone are prevented by means of a porous plug immediately upstream of this zone. Carbon depositon is avoided by cooling the walls of the reaction zone to a temperature several hundred degrees below the reaction temperature.

H. L. Feldkirchner

### Hydrocarbonyls

Mertzweiller, J. K. (assigned to Esso Research and Engineering Co.), PREPARATION OF METALLIC HYDROCARBONYLS. U. S. 2,767,048 (1956) October 16.

This invention provides a simple and novel process for preparation of aqueous solutions of metallic hydrocarbonyls and their salts, and particularly cobalt hydrocarbonyl, $H(Co(CO)_4)$. The process comprises treating an aqueous solution of a cobalt salt of an organic or inorganic acid with carbon monoxide and hydrogen at elevated pressures and temperatures. It is also necessary that the treatment be carried out in the presence of a suitable organic solvent to obtain appreciable yields of cobalt hydrocarbonyl. Apparently the conversion of the cobalt salt to the desired product takes place in the organic solvent and is then simultaneously extracted by the aqueous phase. The latter upon separation from the organic solvent gives the desired product in aqueous solutions.

Author's Abstract

### HCN Synthesis

Wagner, E., Konstanz, Germany (assigned to Deutsche Gold-u Silber-Scheideanstalt vorm. Roessler), PROCESS FOR THE PRODUCTION OF HCN FROM VOLATILE HYDROCARBONS AND AMMONIA. U. S. 2,768,876 (1956) October 30.

An improved process for the production of hydrocyanic acid from ammonia and volatile hydrocarbons is described. By constructing the walls of the reaction chamber of alumina containing 0.7 to 8% of silica, it was found that the activity of the platinum metal catalyst is considerably higher than when either pure alumina or alumina containing a higher concentration of silica are used.

H. L. Feldkirchner

### Phenol Recovery

Auvil, H. S., and Schmidt, L. D. (assigned to Allied Chemical & Dye Corporation), ELIMINATION OF PHENOL FROM COKE PLANT EFFLUENTS. U. S. 2,768,977 (1956) October 30.

Known countercurrent contacting of crude ammonia liquors with light solvent liquids (benzene) to remove phenols, with subsequent contacting of the resultant phenol-bearing solvent with caustic soda solution to purify the solvent for recycling to the first stage, is improved by splitting the returned solvent and mixing up to 70 per cent of it with the fresh caustic, then adding the mixture to the second (solvent dephenolization) stage continuously. Centrifugal countercurrent contactors are preferred. Phenol extraction is raised from 90 up to 99 per cent. O. P. Brysch

Grindrod, J., NEW-TYPE SOLVENT EFFLUENT CONTACTOR IN U. S. PHENOL RECOVERY PLANT. *Chem. and Process Eng.* (British), 37, 399-401 (1956) November.

A new continuous counter-current phenol extraction plant featuring a novel solvent-effluent contactor and using a new type of solvent has recently been put into use by the Koppers Co. Inc. at their Follansbee, West Virginia, coal tar and tar oil processing plant. Here is a description of the plant and the process used.
Author's Abstract

### Tar Acids

Jones, B. W., and Neuworth, M. B. (assigned to Pittsburgh Consolidation Coal Co.), PURIFICATION OF TAR ACIDS. U. S. 2,766,296 (1956) October 9.

Commercial tar acids from coal tars, coal hydrogenation liquids, and shale oils are converted into pure (neutral oil-free) tar acids by first separating the 160° to 240° C range acids into high (plus 200°) and a low (minus 200° C) fractions and treating the first with a double solvent extraction of 0.8 density paraffinic naphtha and 55 to 75% aqueous methanol, and the second with a similar naphtha and 40 to 55% aqueous methanol after which the two methanol extracts are combined and the tar acids are recovered therefrom for a pure-products distillation. O. P. Brysch

Neuworth, M. B. (assigned to Pittsburgh Consolidation Coal Co.), SEPARATION OF TAR ACIDS AND TAR BASES. U. S. 2,766,297 (1956) October 9.

Tar acids are purified from tar bases, by passing the crude unstable acid feed, in aqueous methanol solution, through a bed of synthetic silica-alumina cracking catalyst, adsorbing the bases upon the catalyst and recovering the base-free solution of tar acids. When saturated with bases, the catalyst is regenerated by washing with sulfuric acid in aqueous methanol, or by heating the catalyst in air to 900 to 1200° F.
O. P. Brysch

## 10. CHEMICAL ENGINEERING

### Air Separation Plants

Kerry, F. G., LOW TEMPERATURE AIR SEPARATION PLANTS. *Chem. Eng. Progress*, 52, 441-47 (1956) November.

Data and information on the safe design and operation of low temperature air separation plants are presented and discussed. The effect of air contaminants, such as acetylene, methane, nitrogen oxides and ozone on producing explosions is examined. Safe design of the vaporizer, silica gel filters, air compressors and expansion machines is presented in detail. Safe operating practices for oxygen plants are outlined. E. J. Pyrcioch

### Column Costs

Swanton, W. F., HOW TO SPECIFY A COLUMN. *Petrol. Refiner*, 35, 113-15 (1956) October.

Specifications which include realistic pressure and temperature requirements, allow use of manufacturer's standards, and avoid specifying non-essential details are factors in getting the best column at lowest cost.
Author's Abstract

### Heat and Mass Transfer

Cribb, G. S., and Nelson, E. T., HEAT AND MASS TRANSFER COEFFICIENTS IN GAS WORKS PLANT DESIGN. Gas Council Res. Commun. GC32 (1956) November 20 (1956); *Gas World* (British) 144, 1070, November 24; *Gas J.* (British) 289, 84-6 (1957) January 9.

A comprehensive review is given for computing temperature effects on the transport properties of gas mixtures. The theoretical equa-

tions derived from kinetic theory of gases and liquids are applied to a typical town gas mixture, and it is found that calculated viscosity and thermal conductivities agree satisfactorily with experimental values. However, the observed variation with temperature of the thermal diffusity is greater than kinetic theory predictions. Experimental values of the transport properties are used in computing a relationship between heat and mass transfer between water vapor and coal gas. The relationship is then applied in a design method to evaluate the performance of a cooling and condensing system in a carburetted water gas plant. C. G. von Fredersdorff

Otten, P. S. HOW TO SPECIFY A HEAT EXCHANGER. *Petrol. Ref.*, 35, 116-18 (1956) October.

Do you really need a square-diagonal tube pitch? How about safety factors? They may be costing you money when ordering heat exchangers. There is a right and a wrong way to specify heat exchangers. Author's Abstract

Smith, E. C., HOW TO SPECIFY COOLING TOWERS. *Petrol. Refiner*, 35, 125-29 (1956) October.

This article briefly discusses the following subject matter useful as a guide to cooling tower specification: 1) factors affecting tower rating and performance. 2) design features. 3) materials of construction. 4) mechanical equipment. 5) testing procedure and code. 6) wood treatment. 7) data furnished by manufacturer. 8) equipment or work ordinarily furnished by manufacturer. R. F. Bukacek

## Nuclear Fuel Operations

Fermi, E., and Anderson, H. L. (assigned to United States of America), TESTING MATERIAL IN A NEUTRONIC REACTOR. U. S. 2,768,134 (1956) October 23.

A method is claimed for testing the neutronic purity of a sample of fissionable material with respect to a standard in a graphite moderated reactor by noting changes in the equilibrium position of the calibrated control rod. The method represents a rapid procedure for evaluating the purity of fissionable material, particularly for traces of neutron absorbers such as boron, cadmium, samarium and gadolinium. C. G. von Fredersdorff

Rohrmann, C. A., REMOTE OPERATIONS IN U-235 PROCESSING. *Chem. Eng.*, 63, 195-98 (1956) October.

The separation of plutonium and fission products from irradiated uranium requires extensive processing which can be done safely only by remote control operations. Heavy equipment is handled by a remotely controlled crane, and viewing is achieved by periscope. Pipe connections to process vessels are made by a jumper which has special fittings that can be tightened by an impact wrench. Other examples and drawings are given. C. G. von Fredersdorff

## Radiant Heat Transfer

Sleicher, C. A., Jr., and Churchill, S. W., RADIANT HEATING OF DISPERSED PARTICLES, *Ind. Eng. Chem.*, 48, 1819-24 (1956) October.

Mathematical derivations, interpretations and dimensionless parametric graphs are presented for unsteady state heat transfer to fine particle dispersions subjected to constant radiant heat flux. The solutions for temperature distribution within the particle were obtained under the assumptions that the effect of the rate of change of particle diameter on the rate of heat and mass transfer is negligible and that the rate of heat transfer to the surrounding air by conduction and evaporation can be expressed in terms of an overall transfer coefficient and a temperature difference based on an infinite medium. C. G. von Fredersdorff

## Reactor Design

Lobo, P. A., and Sliepcevich, C. M., HIGH-PRESSURE, HIGH-TEMPERATURE CHEMICAL REACTORS, *Research and Eng.*, 11, 32-35 (1956) October.

A general discussion is given of the problems involved in designing equipment, selecting materials of construction, closure types and various auxiliaries for processing at high pressures and temperatures. Conditions up to about 25,000 psi at 1200° F are considered. E. B. Shultz, Jr.

## Water Purification

Kirkham, T. A., MORE FRESH WATER VIA MEMBRANES. *Chem. Eng.*, 63, 185-89 (1956) October.

Purification of sea water or highly saline water

by an electric membrane process is discussed. Operating costs are tabulated for a few plants now in operation. W. G. Bair

McRae, A. D., Ross, W. K., and Sheppard, A. A., BIOLOGICAL OXIDATION OF PHENOLIC WASTE WATER. *Oil Gas J.*, 54, 223-27 (1956) August 20.

Waste water with phenol content up to 400 ppm. can be treated by biological oxidation for 99-100% phenol removal. The process is described in detail with flow sheets. W. G. Bair

## 11. PROCESS EQUIPMENT AND INSTRUMENTATION

### Computers

Hannula, F. W., THE BTU COMPUTER—AN ADVANCED DATA SYSTEM FOR INDUSTRY. *Canad. Chem. Processing*, 40, pp. 89-91, 94, 96 (1956) November.

The author describes an integrated system designed to combine flow and temperature difference measurements to give direct indication of heat effect on a process stream. A bridge circuit, with varying input, is employed. R. T. Ellington

Hussey, J. L., PROCESS CONTROL AND ANALOG COMPUTER. *Instr. and Autom.*, 29, 2000-04 (1956) October.

After a brief explanation of the elements that make up an electronic analog computer, two examples are given use of this type to design the control system for a process and to control the process. The desirability for process engineers to familiarize themselves with electronic control equipment is emphasized. G. G. Wilson

Klein, M. L., Williams, F. K., Morgan, H. C., DIGITAL PROCESS CONTROL. *Instr. and Autom.*, 29, 1979-84 (1956) October.

This article, the twelfth in a series on digital automation, is concerned with the use of analog to digital convertors, trunking matrices, and comparison matrices to control processes with an accuracy of up to 0.1%. The type of equipment and procedures used to achieve automatic process control are illustrated with examples which involve the automatic control of process temperature and pressure by automatically closing and throttling valves. G. G. Wilson

## 12. MATERIALS OF CONSTRUCTION

### Cathodic Protection

Andrus, O. E. (assigned to A. O. Smith Corp.). CATHODICALLY PROTECTED WATER HEATER STORAGE TANK WITH GAS DISPOSAL ATTACHMENT. U. S. 2,764,541 (1956) September 25.

This patent involves an attachment for gas water heaters which will automatically release from the heater tank any hydrogen gas produced as a result of the application of cathodic protection to the tank interior. G. G. Wilson

Waldron, L. J., Nelson, E. E., and Peterson, M. H., MAJOR FACTORS IN THE CATHODIC PROTECTION OF STEEL IN SEA WATER. U. S. Dept. Commerce, PB 111807 (1955) August 19.

A summary of published information and of results obtained in tests at the naval Research Laboratory on the proper criterion for the cathodic protection of steel in sea water and on the major factors influencing cathodic protection current distribution. This summary also includes a resumé of the historical development of the electrochemical theory of corrosion and cathodic protection. G. G. Wilson

### Coatings

Clayton, H. M., TESTING WRAPPINGS ON CATHODICALLY PROTECTED SUBMERGED PIPE AND FITTINGS. *Corrosion*, 12, 455t-58t (1956) September.

The results of tests of 10- and 20-mil thick plastic tapes applied to a standard combination of pipe and fittings and submerged in a salt solution in tap water are presented. The pipe and fittings used included two straight pieces of pipe, two caps, and an elbow. The resistivity of the salt solution was adjusted to 2000 ohms/cu cm and a rectifier was used to impress pipe-to-electrolyte potentials of −0.85 to −2.30 volts with respect to a saturated copper-sulfate half-cell on the submerged pipe. The results are expressed as rate of protective current flow into the coated test specimen versus time. G. G. Wilson

Curtis, A. C., and Cooper, J. C. INTERNAL MAINTENANCE SOLVES MANY TRANS-

MISSION PROBLEMS. *Gas*, 32, 113-14, 118-19 (1956) September.

The utility of in-place internal coating of pipelines in gas service is described. The methods and materials used are discussed and the results of two applications are briefly summarized. G. G. Wilson

Kruger, J., and Bloom, M. C., MECHANISM OF WASH PRIMER ACTION. *Ind. Eng. Chem.*, 48, 1354-60 (1956) August.

A highly technical discussion of the results of a study of the mechanism of the action of the poly-vinyl butyral wash primer usually designated as WP-1, on an iron surface. This study included x-ray diffraction examination of the solid crystalline phases in the wash primer, infrared spectroscopic studies of poly-vinyl butyral films, paramagnetic resonance studies of wash primer-heated surfaces with metallurgical and electron miscroscopes. The results obtained were used to form an elementary picture of the structure of the wash primer film and the mechanism of its formation on an iron surface. G. G. Wilson

## Corrosion

Evans, U. R., PITTING AND CRACKING. *Chem. and Ind.* (British), No. 44, 1921-97 (1956) November 10.

This article tries to point out the importance of localized attack of metals causing corrosion and premature perforation. Since much research was carried out on metallic corrosion under conditions to cause uniform attack it was recognized that the types of corrosion which cause trouble in service are pitting and cracking. The starting places of attack as well as the healing and spreading of corrosion is discussed. Corrosion patterns on zinc and iron plates as well as the pitting on aluminum and the spots on tin are explained. Pitting of tin in distilled water as well as pitting at gliding planes was given consideration. Intergranular weakening and intergranular corrosion is a major discussion in this article along with other topics like stress corrosion cracking, corrosion fatigue and prevention of cracking. G. Kunst

## Corrosion Economics

Dillon, C. P., SOME CONSIDERATIONS IN THE ECONOMICS OF TANKER CORROSION. *Corrosion*, 12, 67-69 (1956) September.

A concept is presented whereby the capitalized cost of deferred repairs is considered when economic justification of corrosion control measures on oil tankers is contemplated. The author suggests a means whereby data pertaining to tankers can be used in establishing justification for or causing abandonment of corrosion control schemes. When capitalized cost is considered, the savings attributable to corrosion mitigation measures are much less than when calculated without taking into account earned interest on accumulated repair funds. Formulae are presented and a suggested graphical presentation of the data is included. Author's Abstract

## Metal Cleaning

Liebman, A. J., BLAST CLEANING AS A MEANS OF PREPARING METAL SURFACES FOR PAINTING. Amer. Gas Assoc. Opertg. Sect. Paper DMC-56-29 (1956) May 7-10.

A comprehensive, well illustrated presentation of the utility of blast cleaning of metal surfaces for painting. It includes brief discussions of the important relationship between the characteristics of the coating to be applied and the type of surface preparation desired and of the classification of blast-cleaned surfaces, but is concerned primarily with the selection of blast-cleaning equipment and abrasives. G. G. Wilson

## Silicon Carbide

Taylor, K. M., IMPROVED SILICON CARBIDE FOR HIGH TEMPERATURE PARTS, *Materials & Methods*, 44, 92-95 (1956) October.

By using silicon carbide itself as a bonding medium, a dense superior type of refractory called KT silicon carbide has been produced. This new material has an unusually high thermal conductivity and low thermal expansion. It can be formed by conventional methods such as pressing in steel molds, casting and extruding. After forming, the parts are subjected to a special high-temperature treatment that produces a dense self-bonded body. Silicon carbide content of the KT compound ranges from 95 to 98 per cent. At present, this new silicon carbide is available only in limited quantities for development testing. E. J. Pyrcioch

### Vanadium

Roberts, B. W., and Rogers, H. C., OBSERVATIONS ON MECHANICAL PROPERTIES OF HYDROGENATED VANADIUM. *J. Metals (Trans. AIME)*, 8, 1213-15 (1956) October.

Vanadium foils and wires, either cold-worked or recrystallized, show a ductile-brittle-ductile fracture sequence with temperature. At about 150°C the hydrogenated vanadium wires are found to be ductile. At room temperature the wires show brittle fracture, and at liquid nitrogen temperature the wires are again ductile, although to a lesser extent than found at 150°C. Hydrogenated cold-rolled vanadium foils have been found to fracture in unusually straight lines along the (100) texture directions. The hydrogen content required to show this (100) texture fracture is limited to a few atomic per cent in range. Hydrogen content above this range causes fracture to occur in random directions. Authors' Abstract

## 13. NEW BOOKS

### Control System Design

Young, A. J. AN INTRODUCTION TO PROCESS CONTROL SYSTEM DESIGN. Pittsburgh: Instruments Publishing Co., 1955.

The author endeavors to remedy three defects he feels exist in present practice and knowledge because of the emphasis placed on equipment development and the little theoretical work done. First, only qualitative information about the controlled process and plant has been available while that on equipment performance is quantitative. Only qualitative information is available on application technique and the full potentialities of automatic process control have not been realized, often because of the mathematical difficulties involved. This treatment adopts the frequency response approach.

R. T. Ellington

### Farm Fuel

Brodell, A. P., and Kendall, A. R., LIQUID PETROLEUM FUEL CONSUMPTION FOR FARM PURPOSES. Agric. Research Service Statistical Bull. No. 188: Washington, G. P. O., (1956) July.

### Illinois Coking Coals

Jackman, H. W., Eissler, R. L., and Reed, F. H. COKING COALS OF ILLINOIS, Ill. State Geo. Surv.; Urbana: Circ. 219, 30pp. (1956).

Pilot-plant coking tests on blends of Illinois and eastern coking coals used in the midwestern area showed that Illinois coals exert a relatively low expansion pressure on coke-oven walls and as such may be added to expanding eastern coals to reduce the pressure exerted on coke-oven walls. A further advantage in blending Illinois coals with eastern coals is the increase in coke stability. Freight rates on Illinois coals and eastern coking coals to Chicago and St. Louis areas are compared. The freight charges per ton of furnace coke produced in these areas are reduced when Illinois coals are used. K. C. Channabasappa

### Pipelines

Johnson, A. M., THE DEVELOPMENT OF AMERICAN PETROLEUM PIPELINES. Ithaca: Cornell University Press, 1956.

This book presents an exhaustive study of the interplay of private enterprise and public policy forces in the development of oil pipelines from 1862 to 1906. The bitter attacks by teamsters, efforts of the railroads to dominate pipelines, and attempts of all groups to obtain favorable legislation are covered. The rise of Standard Oil, the challenge to Standard's dominance and the origins of public policy are presented in a manner that will be interesting to all concerned with the relationship of private enterprise and public policy. R. T. Ellington

### Zirconium

Shelton, S. M. (and staff), ZIRCONIUM—ITS PRODUCTION AND PROPERTIES. U. S. Bur. Mines, Bull. 561 (1956).

A comprehensive report on the occurrence, metallurgy and uses of zirconium. Chapters on the properties, fabricating methods, alloys and uses of this metal are included, as well as a chapter on procedures used to analyze alloys and ores containing zirconium. Each of these chapters has been prepared by an expert in the particular subject discussed. G. G. Wilson

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Bituminous Coal Research Reports
Brennstoff-Chemie
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Chemical and Engineering News
Chemical and Process Engineering
Chemical Engineering
Chemical Engineering Costs Quarterly
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Reviews
Chemical Society (London) Journal
Chemical Week
Chemistry and Industry
Coal Heat
Coke and Gas
Combustion
Combustion and Flame
Computers and Automation
Construction Methods and Equipment
Corrosion
Corrosion Technology

Drilling

Engineers' Digest
Erdöl und Kohle

Faraday Society. Transactions
Fuel
Fuel Efficiency
Fueloil and Oil Heat

Gas
Gas Age
Gas and Oil Power
Gas Council (British) Publications
Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins, Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
Lubrication

Materials and Methods
Mathematical Aids
Mechanical Engineering
Metal Progress
Mining Engineering

National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News
Nuclear Science and Engineering
Nucleonics

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics and Chemistry of Solids
Physics Today
Pipe Line Industry
Power
Producers Monthly
Public Utilities Fortnightly

Radiation Applications
Refrigerating Engineering
Review of Scientific Instruments
Revue Generale du Gaz
Rivista dei Combustibili

Science
Svenska Gasverksföreningens Månadsblad

U.S. Bureau of Mines, Bulletins, Information Circulars, Reports of Investigations and Technical Papers

World Oil
World Petroleum

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY